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(71)(72) Applicant and Inventor: LI, Lin [GB/GB]; 5 Redmain Way, Fir Tree Drive South, Liverpool L12 0LU (GB).

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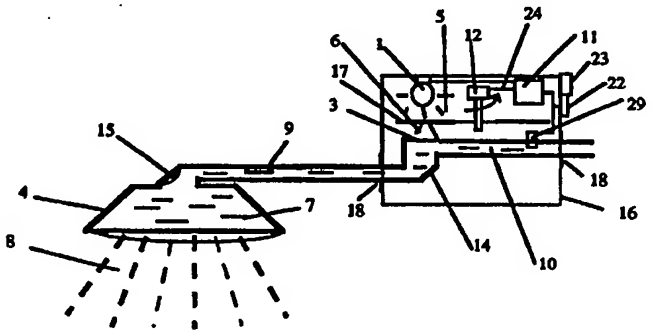

(57) Abstract

Apparatus and a method whereby waters or water streams (10, 7) in sanitary installations such as shower systems, tabs and bath tubs are introduced with electromagnetic waves, especially visible light (1) and infrared or ultraviolet lights. When said electromagnetic waves are visible light, the illumination of said water takes place in one or combination of the two forms: illumination by light reflection from the turbulent or broken water streams and illumination by light carried by the unbroken water streams or waters, where the electromagnetic waves being introduced into the water streams is able to be carried and guided by the water streams (8) because of higher optical refractive index of the water compared to the air. Further, part of sanitary installations such as part or whole of the shower head is illuminated by the said light sources. The colours and/or patterns and/or the intensities of said light source is able to be adjusted manually or automatically according to certain water conditions such as the temperature or the flowrate/pressure or cleanness of the water in use. The said optical source (1) is placed at said shower/tap head (4) or separated from it. In the latter case reflective mirror means (15) or optical wave guide means or fibre optic means is used to guide the optical energy from said light source (1) to the appropriate water streams (10 or 7). When the light source resembles sun light, combined sun bathing and shower unit can result.

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APPARATUS AND METHOD FOR INTRODUCING ELECTROMAGNETIC WAVES INTO WATER

The present invention relates to apparatus and a method for improving convenience, safety and pleasure of water based body cleaning such as taking shower, bath or hand/face washing by introducing to waters or part of sanitary systems with electromagnetic waves, especially visible lights, infrared light and ultraviolet light.

According to the present invention, there is provided apparatus for the introduction of electromagnetic waves into a water stream, the apparatus comprising:
a source of electromagnetic waves;
conduit means for providing a water supply;
means for admitting said electromagnetic waves into said water supply;
and said conduit means further including water exit means for forming said stream of water outside conduit means.

The illuminating effects, when visible light source is used, take place in one or combination of the three forms: 1) Illumination of water by light reflection from the turbulent or broken water streams. 2) Illumination water by light or electromagnetic waves carried by the unbroken water streams or waters, where said electromagnetic waves or light being introduced into the water steams is able to be carried and guided by the water streams because of higher optical refractive index of the water compared to the air. Especially if the electromagnetic waves or light from inside the water strikes the water/air interface at angles beyond a critical value, total reflection within the water stream is resulted. 3) Part of sanitary installations such as part or whole of the shower head is illuminated by said light sources or electromagnetic waves of various spectrums.

The colour and/or patterns and/or the intensity and/or pulse frequency and/or pulse duty cycles and/or shapes, and/or wavelength/spectrums of the said light may be adjusted manually or automatically according to the user's demand or certain water conditions such as the temperature or flowrate/pressure or quality of the said water (pH values, hardness, cleanness, degree of contamination etc.) which can be detected with one or a number of water condition sensing means. This feature enables the user to know the water condition visually by looking directly at the water streams out of the shower/tap head or by the illuminated part of the sanitary unit without having to touch the water. The said light source can be placed at the said shower/tap head or separated from it. In the latter case light guiding means such as reflective mirror means or optical wave guide means, can be

used to guide the optical energy from the said light source to the appropriate water streams. The light source can also be placed, introduced or embedded in a bath tub. Water condition related light parameter changes can also be incorporated in the bath case. Further an audible sound production means may be incorporated into the said sanitary installations to produce sound or music or warning signals according to water conditions or the said light variations.

The above features would provide increased convenience, safety (especially for child and skin sensitive persons), and pleasure of water based body cleaning because of the illuminated/coloured sanitary system or water streams flowing over the user body and non-contact means of indicating the water condition.

For industrial and environmental water monitoring, it also provides a convenient way of indicating the water conditions such as cleanness at the user end by directly viewing the water colours or other light parameters such as intensity, patterns coming out of the water taps.

When the light injected into the water streams resembles the sunlight spectrum with certain brightness, a combined sun bathing and showering sanitary installation can result, which makes better use of light energy because of confined and guided light by waters. Further, the heating of body can be reduced due to the cooling effect of the water.

If the injected light/electromagnetic waves are in certain selected spectrum such as infrared spectrum, the resulting sanitary units can be used for medical treatment or medication purposes. Other applications of the invention may exist depending on the light wavelength and patterns.

Water based body cleaning such as taking shower, bath or hand/face washing with hot and/or cold water are part of everyday life for most of people on our planet. The existing sanitary systems used in domestic and commercial places (such as hotels) provide plain water with no colour or optical light illumination to waters or part of sanitary systems. Further the water temperature control is often by means of manual adjustment or certain degree of automatic means without means of directly indicating the actual water temperature in use. Thus often a period of time is required before the water reaches the set temperature. Often people use direct body contact method to "feel" the actual water

temperature. Accidents such as hot water scalding of skin (especially for children) or cold water caused illness (when there is a sudden drop of water temperature due to say empty hot water tank), or chemical or acid damage to the skin (especially for those who have sensitive skins or skin problems) due to , say, pollution or excessive chemicals in the water, can occur for the existing sanitary systems due to the lack of direct, non-contact means of indicating the water conditions.

If part or whole of the shower head or water taps used in sanitary installations are illuminated or produced with colourful rains of light in the water streams, additional pleasure can be enjoyed by the user. Especially for children, the fun of shower could be increased with colourful light coming with the water they use. If the colour or pattern or intensity of the light carried by the water streams exiting from the shower head or water taps can vary with the water condition such as temperature, pressure or cleanness of the water, great convenience and safety of sanitary actions can be provided.

Sun bathing has been one of the pleasures and healthy practice for human being. Especially sun bathing on sea beaches or by swimming pools where water playing and sun bathing can be enjoyed together. However either because of time or cost or weather concern, people may not be able to enjoy the sun bathing as they wanted. Although facilities are available to produce simulated sun light at homes, the fun of sun bathing with water can not be re-produced. Further the control of light radiation to reach hidden parts of body is often difficult since light only travels straight. The heat generated by the light can also cause damage to the skin. If a sanitary installation can be provided which combines the light and waters, especially the light being able to travel with the waters, showering, bathing and hand/face washing can be at the same time be sun bathing when the light spectrum used in the said light source resembles the sun light spectrum. All parts of the body can be sun bathed and water bathed at the same time, since the light can be guided by the water similar to the way being guided by the optical fibres. The energy of light can be used more efficiently since the light is confined to the parts guided by the water streams. The cooling of body at the same time can result. Further pleasure may be enjoyed to see the light spots "dancing" on the skin. The jumping of light may be made to relate to the music played.

Using infrared lights or rays for medical treatment have been practised world wide. This is often done by placing part of human or animal body at or near an infrared wave generator such as an infrared light bulb. The treatment can result in an improved healing of a wound

or skin illness or the relief of sore or pain. With the present invention the provided sanitary installations can give additional benefit of water based or highly directed localised infrared beam medical treatment if the said injected light/electromagnetic waves are selected to be in certain infrared spectrum.

Illumination of bath room space with different types of lighting facilities such as colour light on the ceiling or walls of the room have been seen in some of the commercial installations such as hotels as well as domestic environment. However these lighting have no connection to and are not part of the sanitary installations. Further the lights are not introduced into the water streams to be carried to the user. Lights from such lighting could shine on the water streams exiting from the shower head or water taps when the angle of the light or shower head or water tap is right. However because of much reduced intensity of light that shine on the water (since other parts of the light are used for the illumination of the room space) and the angle of incidence of the light to the water is not controlled, the light rays usually just pass through the transparent water and travel separately with the water streams. The illuminated effect on water thus can not result. Further, these lights are not related to the water conditions such as temperature of the water.

Lights or coloured lights in the water have been seen in commercial light shows and displays such as light fountains. These waters and installations are not for sanitary purposes thus there is no direct contact of the optically illuminated water with human body. Therefore they do not contribute to the pleasure and convenience for people using sanitary equipment at home or in hotels or other places. Further the lights used for illuminated fountains have not been used to indicate water conditions such as temperatures or quality of water to benefit for end users of the water.

In environmental water monitoring practice, colorimeter and photometers are used for off line in direct water quality testing in industries. These meters involve sampling of water and deposition of certain chemical agents into the testing water sample collected and separated from the water stream. Chemical reaction takes place between the added agents and certain chemicals in the water contained in a transparent test tube. These reactions can result in water colour changes. Thus by shining a light through the testing water, the intensity, colour or spectrum of the light through the water can be detected with an optical sensor. These are related to the content of the certain chemicals in the water to indicate water quality according to the known chemical reactions. In these processes the water

samples used for testing (adding chemicals and passing light through) are polluted by the added chemicals and are not going to be reused by end users. Here the sampled water is used for testing purposes which certainly is not suitable for sanitary purposes. Further the test is not continuous and slow, which can not be used to indicate the flowing water conditions in real time.

According to the present invention there is provided sanitary installations such as shower, bath or hand/body washing systems with illuminated parts near the water exit end and/or illuminated waters both/either internally carried by the water and/or externally by reflection of light from the water streams. Further the colour, and/or intensity, and/or patterns and/or wavelengths and/or polarisation status of the said light may be varied with the water condition such as the temperature, cleanness, pressure of the water. It is one object of the present invention to increase the convenience, safety and pleasure of the water based body cleaning. It is another object of the invention to provide means of direct, non-contact indication of water conditions by the illumination condition in the water stream or part of water delivery unit.

In one embodiment of the invention electromagnetic waves are introduced into the water streams. The apparatus of achieving so comprising
a source of electromagnetic waves;
conduit means for providing a water supply;
means for admitting said electromagnetic waves into said water supply;
and said conduit means further including water exit means for forming said stream of water outside conduit means.

The means for admitting said electromagnetic waves into said water supply may comprise window means transparent to said waves.

The window means may be provided in said conduit means.

The source of electromagnetic waves may emit said wave as visible light or as infrared or ultraviolet radiation.

The water exit means may comprise a tap, a shower head having a plurality of water exit orifices, a hot and cold water mixing tap, water heating means, industrial and water system, industrial and domestic water based waste disposal systems.

The source of electromagnetic wave may be placed adjacent said tap or shower head or remote from said tap or said shower head.

The electromagnetic waves may be introduced into said water supply from said source by mirrors arranged between said source and said window.

The electromagnetic waves may be introduced into said water supply by fibre optic means arranged between said source and said window.

The electromagnetic waves may be introduced into said water exit means by optical waveguide of said conduit with or without reflection coatings on the inner walls of said conduit.

The source of electromagnetic waves may be contained within an enclosure insulated from said water supply.

The electromagnetic waves may be introduced into said water supply by optical fibre means which are housed for at least part of their length within said conduit means.

The ends of said fibre optic means remote form said source may be provided with lens means for transmitting said waves through said window means into said water supply.

The fibre optic means remote from said source may be situated in said water supply before said water exit means.

An article selected from the group comprising: a colour filter, a polarising filter, a pattern mask, an optical mask and optical lens means may be situated between said source and said water supply.

The means may be provided to switch on or off said source of electromagnetic waves according to at least one preselected water parameter selected from the group comprising: temperature, pressure and flow-rate.

The means may be provided for changing the colour of the introduced electromagnetic waves according to at least one preselected water parameter selected from the group comprising: temperature, pressure, flow-rate, chemical composition, purity, turbidity, pH value, hardness.

The means may be provided for changing the parameter of the introduced electromagnetic waves include at least one sensor responsive to the selected water parameter.

The means may be provided to pulse said electromagnetic waves in said water stream.

The sound generating means may be incorporated to provide signals responsive to a preselected water condition parameter.

The means may be provided to vary the intensity of said electromagnetic waves.

The illumination means may be provided to direct electromagnetic waves onto said water streams after exiting from said water exit means.

The illumination means may comprise optical source associated with said water exit means.

The water exit means may comprise at least having a plurality of orifices for forming a shower spray.

The plate having orifices on the water exit means may be partially or totally transparent to said visible light.

In one embodiment of the invention a light beam or a number of light beams are introduced into the shower/tap water streams before or just after the said water exits the said shower head or the said water tap isolated from the light source by a window member, so that the light is trapped in and carried by the un-broken water streams due to higher optical refractive index of the water compared to the air, which behaves like optical wave-guide

resulting in an illuminated water flowing out of said shower head or water taps. The light injection may be in the form flood light or spot light.

To increase the length of non-turbulent or un-broken water flow, fine tubes may be used to guide the water streams in the shower head. Non-circular nozzle shapes such as triangular or star (with odd number of corners) shapes may be used for the orifices in the shower head.

In another embodiment of the invention, part of sanitary installation, especially the part near the water exit end such as the shower head or tap nozzle are illuminated by one or a number of light sources. The illuminated part may be made of materials partially or totally transparent to light or coated with materials sensitive to light such as phosphorous materials.

In another embodiment of the invention, one or a number of light sources are built into the sanitary system and are used to illuminate or shine upon the water streams especially the broken or turbulent part of water stream by external reflection of light from the said water.

In a further embodiment of the invention the said light beams or light sources of light may be in one or a number of forms of a white light (broad spectrum), or single coloured or multiple coloured light, continuous or pulsed light, constant brightness or varying brightness light, patterned light, uniformly distributed or not uniformly distributed light, polarised light, stationary or moving light.

In a further embodiment of the invention the said light source can be one or a number of light bulbs in various shapes, or light emitting diodes or arc lamps or lasers or other types of electromagnetic wave generators.

In a further embodiment of the invention the said light source can be placed on, at, around, or in close proximity of the said shower head or water tap, or placed separated from the said shower head or water tap.

In a further embodiment of the invention, optical components such as light reflecting mirror means (e.g. polished metal mirrors or glass mirrors or optical prisms), lens means (e.g. focusing lenses of various shapes in various combinations, diffusing lenses), flexible wave

guide means (tubes that transmit light from one end to the other by multiple reflections of the light on the inner walls of the tube. Preferably reflective coatings at the inner walls of water guide are used to reduce the loss of light energy) and commercial optical fibres means (e.g. glass optical fibres) may be used to transmit the said light beams from said light source (which can be separated from the said shower head or water tap) into said water streams so that the electrical components can be avoided at the user end.

In a further embodiment of the invention, part of the sanitary system, especially the part near the water exit end, is shaped to concentrate the light towards the water flow direction and coated with reflective materials.

In a still further embodiment of the invention, optical mask means (means of partially blocking, transmitting, colouring of the light depending on the geometry and patterns and colours and status of the mask. Plastic or glass sheets or dye/liquid filled transparent windows with various colours and patterns, liquid crystal displays or LCD and polarisation control crystals are examples of optical masking means) or optical filter means (which selectively passes certain wavelength(s) of the light depending on the filter materials, colours or coatings) with various colours and/or artistic patterns, or mechanical chopping means (periodically blocking the beam) can be placed between said light source and said water streams to produce patterned and/or coloured or pulsed light in said water or shower streams.

In a still further embodiment of the invention, multiple colours of light can be produced by using a number of light sources with different colours.

In a still further embodiment of the invention the said light sources may be programmable to produce different colour, intensity or patterns.

In a still further embodiment of the invention the said light patterns can also be generated by scanning of optical beams with controlled motion of the one or a number of reflective mirrors.

In a still further embodiment of the invention, the said light sources and/or said light filter means and/or said light mask means can be in stationary or can be in motion.

In a still further embodiment of the invention, the light source may be powered locally at the shower/tap head with batteries or powered remotely and transported to said light source through electrical leads or optical transmitting means.

In a still further embodiment of the invention, said optical masks and/or said optical filters may be fixed or removable or replaceable.

In a still further embodiment of the invention, said light may be switched on/off manually or automatically in accordance with the on/off of the water streams flowing to the exit of said shower head or water taps, or in accordance to the said water conditions.

In a still further embodiment of the invention the parameters of said light such as colour or pattern or intensity or brightness can be adjusted manually by the user or adjusted automatically by a control means according to the water conditions to provide means of non-contact indicating the water conditions by the water streams for end use.

In a still further embodiment of the invention, said control means may include water condition sensing means, light intensity/pattern/colour control means or programmers, optical mask control means, and manual control means.

In a still further embodiment of the invention, said water condition sensing means may include commercial sensors or detectors or transducers for water temperature (such as thermal couple, thermal pile, thermal resister), water flowrate/pressure, water pH value, water hardness, cleanness or chemical contents sensing and to generate, say, electrical, or optical or mechanical or magnetic signals for the said light control means or mask/filter control means.

In a still further embodiment of the invention, said light control means may include variable electric current means, variable electric voltage means, variable electrical resistance means, variable inductance means or variable capacitance means or variable optical polarisation means or variable optical chopping means (blocking the beam periodically) or programmable pulse generator means or mechanical means or digital programmable means with or without a micro-processor or combinations of them to vary the electrical supply to the light sources or vary the said light directly to obtain desired intensity and/or colour and/or patterns of the said light.

In a still further embodiment of the invention, said optical mask/filter control means may include a motion control means such as an electric motor or a hydraulic motor or solenoids or pneumatic control valves to vary the position of the said optical masks or filters aligned with said light source, or a programmable liquid crystal device to vary the light transmission through it or polarisation control device to vary polarisation transmission if the light source is polarised.

In a still further embodiment of the invention said light source may be placed, introduced or embedded in the bath tub for the illuminated effects when the path is filled with water.

In a still further embodiment of the invention, audible sound or music can be incorporated in the sanitary installations produced with one or a number of sound generating means in accordance with said water condition or with said light variations to provide, for example audible warning, voice and music.

In a still further embodiment of the invention the said light source may also include infrared, ultraviolet and other wavelengths, in particular that of sun light to enable sun bathing and shower to be combined at bathrooms. When an infrared light source is used, beneficial effect could be generated to the skin.

BRIEF DESCRIPTION OF DRAWINGS

The invention is now further described by way of examples only, with reference to the accompanying drawings in which:

Fig.1 is a diagram illustrating one embodiment of an illuminated water shower installation with visible light or electromagnetic waves injected into water streams in a shower head or water tap directly.

Fig.2 is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location to the shower head and the light/electromagnetic waves being transmitted to the shower head or water tap in and/or along with the water transportation means with multiple reflecting mirrors and optical waveguide of the section

of the water transporting means. A water condition sensing and light control unit is also described.

Fig.3 is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location from the shower head or water tap and the light/electromagnetic waves being transmitted to the shower head or water tap with a multiple mirror based beam guide separated from the water transportation means. A water condition sensing and light control unit is also described.

Fig.4 is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location from the said shower head or water tap and the light/electromagnetic waves being transmitted to the shower head or water tap with an optical fibre means not coaxial to the said water transporting means. A water condition sensing and light control unit is also described.

Fig.5 is a diagram illustrating an illuminated water shower installation with the light source being placed in a separate location from the said shower head or water tap and the light being transmitted to the shower head or water tap with an optical fibre means in/along with the water transportation means. A water condition sensing, light control and sound generation unit is also described.

Fig.6 is a diagram illustrating three examples of stationary optical masks/filters.

Fig.7 is a diagram illustrating three examples of mobile optical masks/filters.

Fig. 8 illustrates that additional light sources are incorporated into the shower head for the illumination of water streams by visible light reflection from the water streams. The partially or fully transparent member is used as the shower head cap for the illumination effect.

Similar features are denoted by common reference numbers.

Referring now to the drawing in the **Fig.1.** which shows schematically a shower/bath installation with illuminated water streams as one embodiment of the present invention, wherein a light source **1**, which may be enclosed with a water proof box member **20** which

may allow the light to transmit through from one or a number of locations. is placed on/at the shower/tap head **4** (a tap is not shown here). An optical mask/filter **2**, which may consist of a plastic or glass sheet with different colours and geometry patterns or symbols, is placed between the light source **1** and an optical transparent window **3**, which may be of plastic or glass material, fitted and sealed at the back face of the shower head **4**. The mask or masks **2** can be removable or changeable by, say, sliding in/out of a slot between the light source **1** and the transparent window **3**. Water supply **10** is carried by a water pipe **9** , which may be rigid or flexible, to the shower/tap head **4**. The light rays **5** from the light source **1** totally or partially pass through the light mask **2**. The re-emerged light **6** from the mask **2** will have colours and patterns determined by the mask/filter colours, geometry and patterns. For example a red coloured mask will only allow the red light to pass through. This light **6** is injected into the water **7** in the shower/tap head **4** through the water sealed transparent window **3**, so that the said water **7** will be illuminated by carrying part or whole of the light **6** with it when emerging from the shower/tap head outlet for end use. Thus the emerged shower water streams **8** , will have some light trapped in the water streams due to higher refractive index of the water compared to air. This gives a glowing or illuminated effect of the water streams which can be of different colour or pattern or intensity without using additional chemical/dye deposition in the end use water. The light source **1** can be switched on and off by a switch **26**. The light intensity can be adjusted by a control device **27** which may be of variable resistance, or capacitance, or inductance or a semiconductor nature, or a combination of them. The light can be continuous or pulsed. An optional pulse generator **28** can be used to control the light pulses by user selections or definitions. The colour and/or geometric patterns of the light injected into the shower/tap head **4** can be changed or varied with different masks **2**. The lead member **30** can be an electrical or optical one (such as fibre optics, optical waveguide, or multiple mirrors) depending on whether the actual light generating means is located at the shower head **4** or placed at a separate location.

The said light source **1** can also be itself coloured. In this case the colour function of the said optical masks may or may not be used. The masks in this case can be used to block part of the light beams from the light sources to select colours or to create patterns. Mechanical shoppers (blocking the beam periodically in a defined pattern), liquid crystal displays or polarising control means can be used to replace the optical mask/filter in this case for the controlled light transmission.

Fig.2. shows a second embodiment of the sanitary installation wherein the water condition (temperature, flowrate/pressure, chemical composition and quality etc.) can be used to control the parameters of light carried in the shower/tap water streams. In this particular example a multiple reflecting mirror (**14**, **15**) means is used as optical transmission means, which can be placed inside (as shown in the drawing), along with or separated (not shown in the drawing) from the water carrying pipes. The light source **1** is placed remotely from the shower head **4**. Light **5** emitted from the light source **1** is shone on a stationary or a mobile mask means **17** which is placed between the light source **1** and a transparent window **3** leading to the water path. The said mask **17** can have colours and/or patterns. Some examples of the mask **17** is shown in **Fig.7**. The light **6** emerged from the mask **17** will be determined by the colour(s) and pattern(s) of the mask **17**. This light **6** enters the water stream **10** through a transparent and water proof window **3**. Light **6** is then reflected by a reflective mirror **14** to the shower/tap head **4** where another light reflector/mirror **15** is used to direct the light into the water **7** in the shower/tap head **4**. A number of reflecting mirrors can be placed between members **14** and **15** depending on the number of elbows of the pipe **9** has. The mirror means can be a metal piece with polished or coated surface, or a glass piece with reflective coatings or a optical prism. The water streams **8** exiting from the shower/tap head will then carry the light with them. One or a number of water parameter sensing means **29** is(are) inserted into or placed near the water stream lines **10**. These sensors can be one or a number of a water temperature sensor such as a thermocouple, a thermal resister (This sensor does not need to be inserted into the water; it can be placed on the wall of thermally conductive water pipe line **9**), a water flowrate/pressure sensor or a water quality (chemical composition, pH value, turbidity, purity, hardness etc.) sensors. The detector signals on the water condition are sent to a controller **11** subject to selection by a menu/auto switch **22**. If the selection is "auto", then the detected water parameter signals are used to drive the control output(s) **24**. Otherwise the controller **11** is controlled by a user adjustment device **23** such as a switch, rotating knobs or sliding devices of, say, variable resistance nature. The function of the controller **11** is to produce electrical and/or mechanical and/or chemical and/or magnetic and/or optical outputs **24** to vary the pattern and/or colour and/or intensity and or pulse of the light **6** emerging from the mask **17** to the water stream. One of the ways to do so is to rotate the patterned mask disk **17** with an electric motor **12** or a spring loaded mechanical device **12.** The light intensity is varied by controlling the electrical input voltage or current or pulse parameters of the light source **1** using the controller **11**. The pulsing of the light can also be realised by chopping the light by a patterned mechanical choppers. Therefore the water steams **8** exiting from the

shower/tap head to the end users will carry lights that are indicative of water conditions with varying colours, patterns or intensity. This feature is not only useful for domestic and commercial sanitary use for the increased convenience and safety but also useful for environmental and industrial water pollution monitoring. The water pipe lines **9** can be connected to the water monitoring and light control box **16** through connecting members **18**. The section of the water pipelines between mirrors **15** and **14** can be coated with optical reflective materials to reduce the optical energy losses. This section of pipelines can then be used as an optical waveguide.

Fig3. shows a similar embodiment to that illustrated in **Fig.2** apart from that the optical transmission means **(13,14,15)** using multiple mirrors are placed separated from the water pipe lines **9**. The transmission line **13** can be a hollow tube with multiple elbows (each with a reflective mirror) allowing several degrees of freedom in motion. The multiple elbows are not shown in the figure. Other parts of the figure are identical to **Fig.2**.

Fig.4. shows a water parameter controlled illuminated water sanitary (shower) system with fibre optic light delivery **19** outside the water transportation means **9**. Light emerging from the optical mask **17** can be fed into a single or a bundle of optical fibres **19**. A light collecting component such as a lens **31** between the mask or light source and the end of optical fibres **19** may or may not be used to guide the light into the fibres **19**. The optical fibre **19** can be placed outside/along the water pipe line **9** which can be rigid or flexible. At the shower/bath head **4** the light emerging from the optic fibres can be fed into shower head water **7** through a light transparent window **3**. An optical component or components such as a lens **21** placed between the fibre optics **19** and the transparent window **3** may or may not be used to guide the light emerging from the fibre optics through the transparent, sealed (water proof) window **3** into the shower head **4**. The optics **21** can be placed in a water proof box **20**. The rest of the illustrations in this figure are identical to those in **Fig.2**. In some cases, lenses may not be used for optical fibres and each fibre in the bundles of fibres can be placed at a given pattern or set loose.

Fig.5. shows a water parameter controlled light carrying sanitary (shower/bath) system with fibre optic light delivery inside the water streams and also an included sound generating member **25**. In this embodiment the optical fibre(s) **19** transmitting the light from the light source **1** to the shower/tap head **4** is(are) placed inside the water transporting pipe **9**. In addition, a sound generating device **25**, such as a loud speaker, or a

semiconductor buzz or a voice synchroniser or a tape/disk player is used to produce certain sound or music according to the controller **11** outputs which can be related to the water conditions. Other parts of the drawings are identical to those in **Figs.2** and **4**.

Fig.6.shows three examples of the optical masks mentioned in **Fig.1**.as member **2**, where **2.A** illustrates a single coloured mask, **2.B** illustrate a multiple coloured mask and **3.C** illustrates a patterned mask with artistic designs/symbols. The masks can be in other geometric shapes not illustrated.

Fig.7. shows three examples of optical masks used in **Figs.2,3, 4** and **5** as number **17**, wherein **17.A** illustrates a mask with mixed colours or patterns and can be rotating. **17.B** illustrates a mask with continuous varying colours and the mask can be in motion. **17.C** illustration an optical mask with different signs or patterns. The mask can be in motion so that the part aligned with the light source can be varied accordingly.

Fig. 8 shows additional features of the shower system whereby further electromagnetic wave or light sources **21** are incorporated into the shower head shining onto the waters **(8)** at more down stream end where the water is turbulent and/or broken. The light may be directed to the water streams with the help of optical reflectors **33**. The light sources may consists of LEDs, fibre optics or light bulbs of different colours such as red, blue and yellow. The combination of the three colours with different light intensities will produce infinite number of colours on the water streams depending on the programming of the light sources and its power supplies. Further in the drawing, the end plate **32** of the shower head may be partially or totally transparent and may be coloured such that it can be illuminated by the light source **21** above it. These additional features may be incorporated into the sanitary system independently or combined with other features as described in this specifications or drawings of **Figs.1 to 5**.

It should be noted that part or combinations of the above features described in **Figs.1** to **8** may be utilised for a sanitary installation.

Features described in **Figs. 1 to 8** may be interchanged therebetween if desired to achieve particular objectives.

CLAIMS

1. Apparatus for the introduction of electromagnetic waves into a stream of water, the apparatus comprising:
a source of electromagnetic waves;
conduit means for providing a water supply;
means for admitting said electromagnetic waves into said water supply;
and said conduit means further including water exit means for forming said stream of water outside conduit means.

2. Apparatus according to claim 1 wherein said means for admitting said electromagnetic waves into said water supply comprises window means transparent to said waves.

3. Apparatus according to claim 2 wherein said window means are provided in said conduit means.

4. Apparatus according to any of the claims 1 to 3 wherein said source of electromagnetic waves emits said wave as visible light.

5. Apparatus according to any one of claims 1 to 3 wherein said source of electromagnetic waves emits said waves as infrared or ultraviolet radiation.

6. Apparatus according to any one preceding claim wherein said water exit means is selected from the group comprising: a tap, a shower head having a plurality of water exit orifices, a hot and cold water mixing tap, water heating means, industrial and water system, industrial and domestic water based waste disposal systems.

7. Apparatus according to claim 6 wherein said source of electromagnetic wave is adjacent said tap or shower head.

8. Apparatus according to any one of preceding claims 1 to 6 wherein said source of electromagnetic wave is remote from said tap or said shower head.

9. Apparatus according to claim 8 wherein said electromagnetic waves are introduced into said water supply from said source by mirrors arranged between said source and said window.

10. Apparatus according to claim 8 wherein said electromagnetic waves are introduced into said water supply by fibre optic means arranged between said source and said window.

11. Apparatus according to claim 8 wherein said electromagnetic waves are introduced into said water exit means by optical waveguide of said conduit with or without reflection coatings on the inner walls of said conduit.

12. Apparatus according to any one of preceding claims 1 to 7 wherein said source of electromagnetic waves is contained within an enclosure insulated from said water supply.

13. Apparatus according to claim 8 wherein said electromagnetic waves are introduced into said water supply by optical fibre means which are housed for at least part of their length within said conduit means.

14. Apparatus according to either of preceding claims 10 or 13 wherein the ends of said fibre optic means remote form said source are provided with lens means for transmitting said waves through said window means into said water supply.

15. Apparatus according to any one of preceding claims 10, 13, or 14 wherein the ends of said fibre optic means remote from said source are situated in said water supply before said water exit means.

16. Apparatus according to any one proceeding claim wherein an article selected from the group comprising: a colour filter, a polarising filter, a pattern mask, an optical mask and optical lens means is situated between said source and said water supply.

17. Apparatus according to any one preceding claim further including means to switch on or off said source of electromagnetic waves according to at least one preselected water parameter selected from the group comprising: temperature, pressure and flow-rate.

18. Apparatus according to any one preceding claim further including means for changing the colour of the introduced electromagnetic waves according to at least one preselected

water parameter selected from the group comprising: temperature, pressure, flow-rate, chemical composition, purity, turbidity, pH value, hardness.

19. Apparatus according to claim 18 wherein said means include at least one sensor responsive to the selected parameter.

20. Apparatus according to any one preceding claim further including means to pulse said electromagnetic waves in said water stream.

21. Apparatus according to any one preceding claim further including sound generating means to provide signals responsive to a preselected water condition parameter.

22. Apparatus according to any one preceding claim further including means to vary the intensity of said electromagnetic waves.

23. Apparatus according to any one preceding claim further including illumination means to direct electromagnetic waves onto said water streams after exiting from said water exit means.

24. Apparatus according to claim 23 wherein said illumination means comprises electromagnetic wave source associated with said water exit means.

25. Apparatus according to claim 1, claim 23 and claim 24 wherein said water exit means comprises at least having a plurality of orifices for forming a shower spray.

26. Apparatus according to claim 25, said plate having orifices is partially or totally transparent to said visible light.

27. Apparatus according to claims 25 and 26 wherein said plate having orifices is connected to fine tubes for water stream control.

28. Apparatus according to claims 25 and 26 and 27 wherein said plate having orifices have the cross section shapes of said orifices of non-circular geometry.

29. A method for the introduction of electromagnetic waves into stream of water, the method comprising the steps of:
providing a water supply in conduit means;
providing means of admitting said electromagnetic waves into said water supply;
providing means for water supply to exit from said conduit means with said electromagnetic waves therein.

30. A method of indicating water conditions, the method comprising the steps of:
providing a water supply in conduit means;
providing means of admitting said electromagnetic waves into said water supply;
providing means for water supply to exit from said conduit means with said electromagnetic waves therein;
providing means of sensing the water condition;
providing means of the variation of parameters said source of electromagnetic waves according to water condition.

31. Sanitary installations substantially as described herein with reference to **Figures 1-8** of the accompanying drawings.

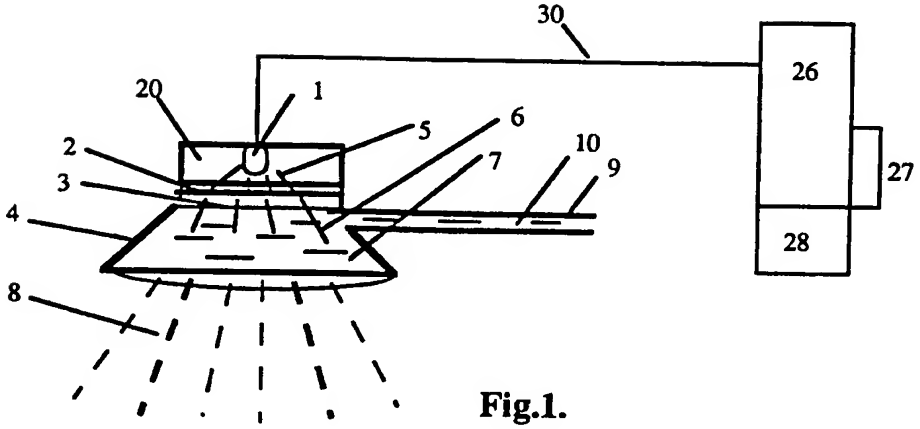

Fig.1.

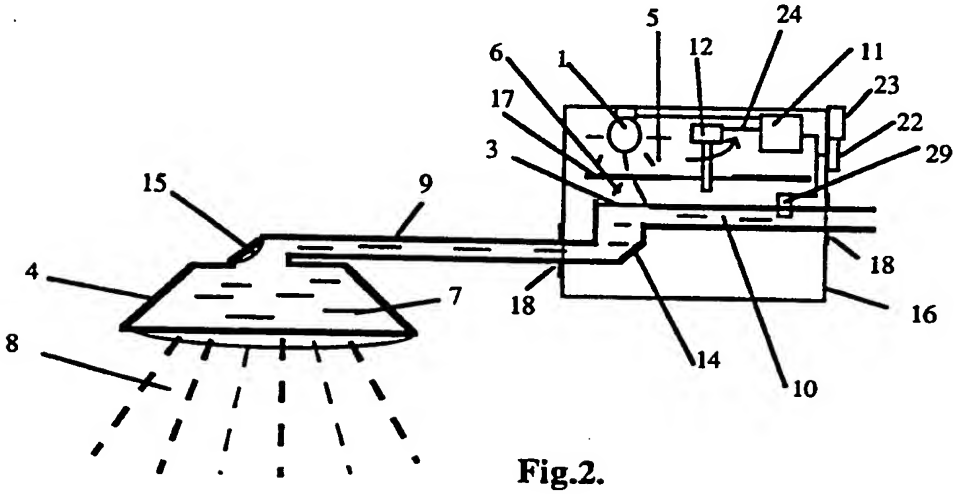

Fig.2.

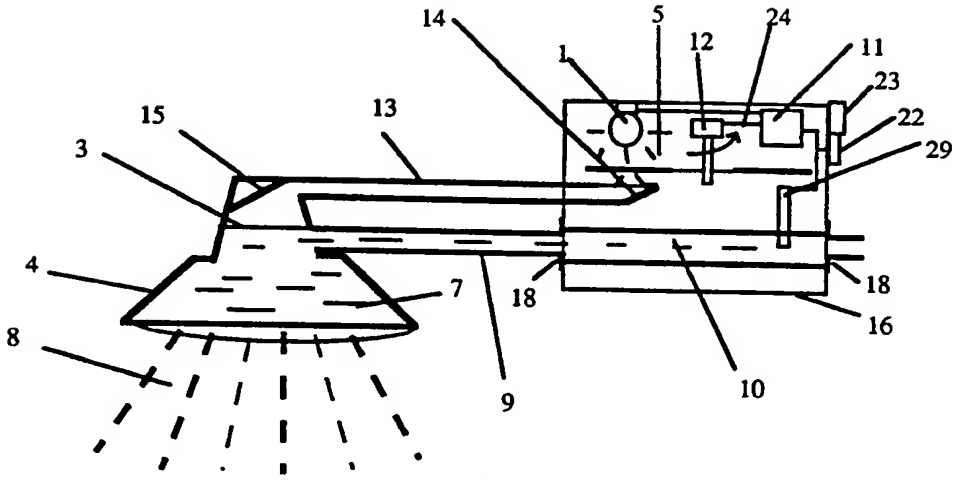

Fig.3.

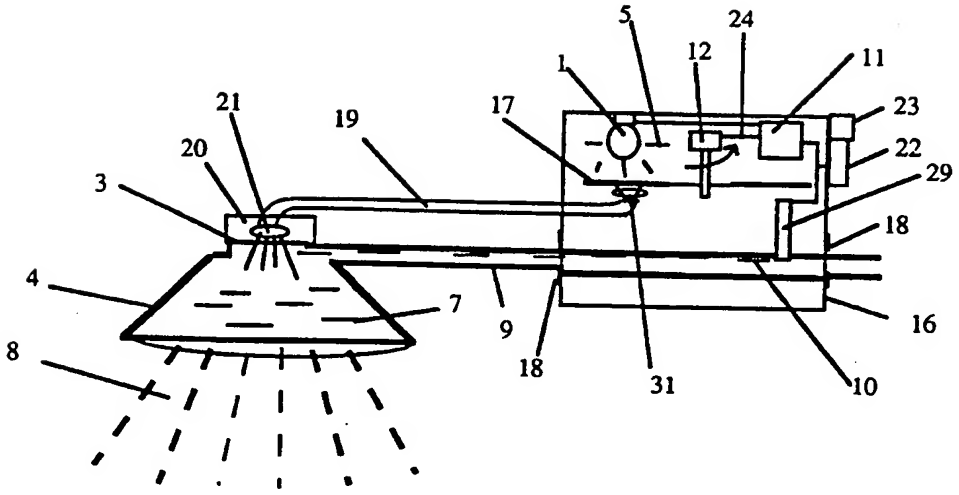
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Fig.4.

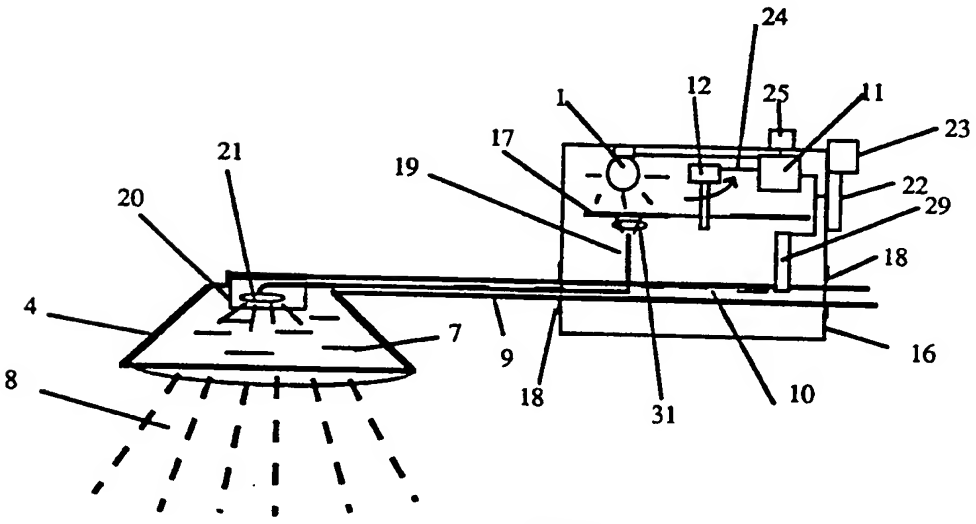
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Fig.5

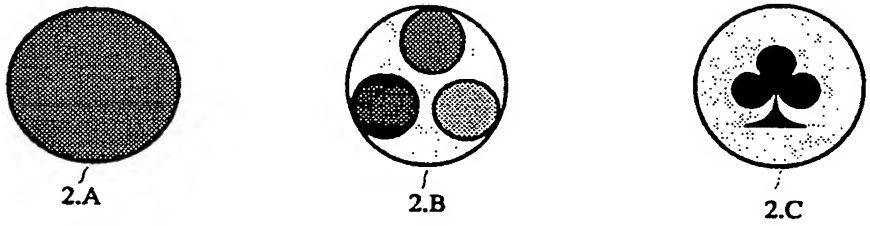

Fig.6

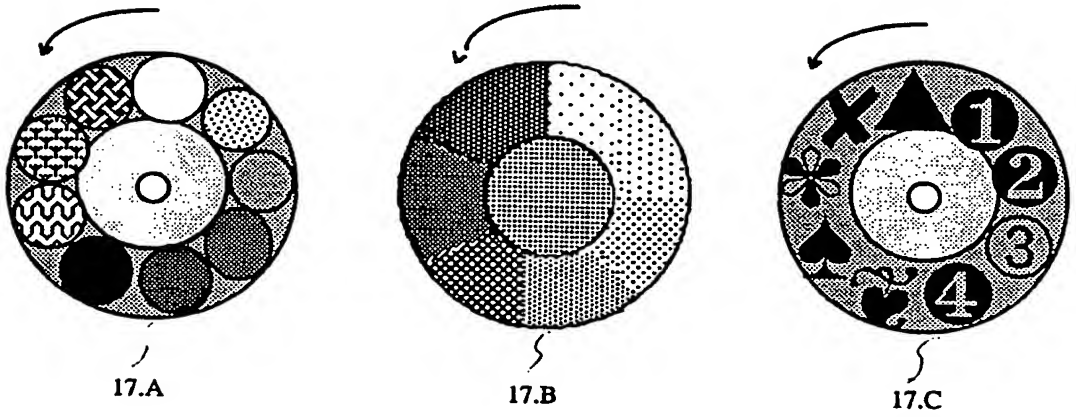

Fig.7.

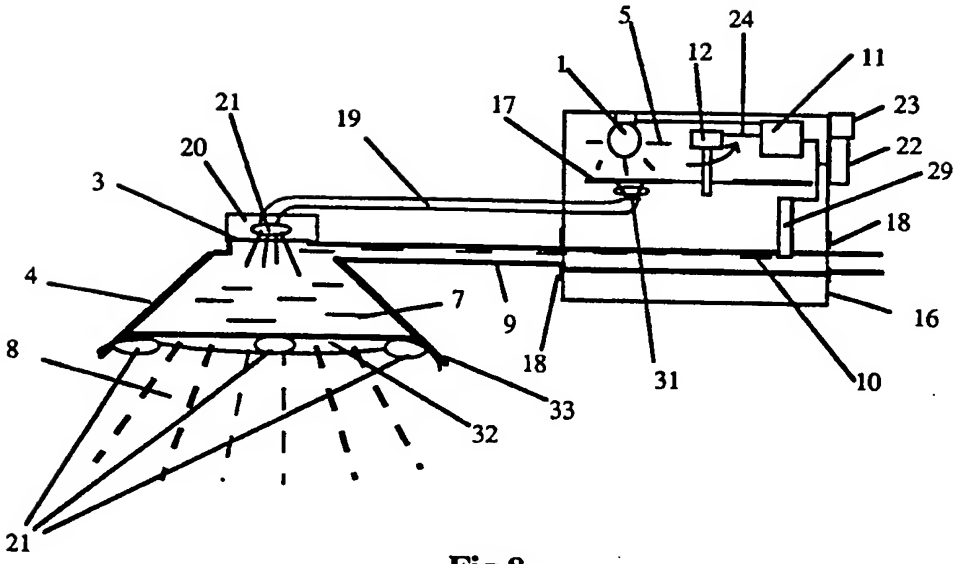

Fig.8.

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/00957

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 E03C1/04

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 E03C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP,A,0 446 365 (INAX CORPORATION) 18 September 1991	1-4,6-8, 10-13, 15, 17-19, 23,25, 29,30
A	see the whole document	9,14,16, 20,24

X	DE,A,31 35 861 (FRIEDRICH GROHE ARMATURENFABRIK GMBH & CO) 24 March 1983	1,4,6, 8-10,12, 23,24, 29,30
A	see the whole document	7,13,14, 26

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
1 September 1995	11.09.95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Van Beurden, J

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/00957

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 17 no. 641 (M-1516) ,29 November 1993 & JP,A,52 002540 (SEKISUI CHEM. CO.LTD) 10 August 1993,	1,4-9, 12,23, 24,29
A	see abstract	2,3,10, 11,13-15

X	DATABASE WPI Week 8243 Derwent Publications Ltd., London, GB; AN 82-P1252E & SU,A,889 131 (FURTO G S) , 25 December 1981 see abstract	1,4,16, 29

A	GB,A,2 020 970 (URQUHART MANNALL) 28 November 1979	

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 95/00957

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		JP-A-	3176519	31-07-91
		US-A-	5171429	15-12-92
DE-A-3135861	24-03-83	NONE		
GB-A-2020970	28-11-79	NONE		